Some Insights into the Dilemma of Distinguishing the Formal and Informal Mathematical Language in Local Languages

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This article presents insights about the mathematical language that is valued in a mathematics classroom where language of learning and teaching is local language. Specifically, the paper focuses on how mathematics teachers recognize the informal way of talking mathematics from the formal way of talking mathematics, how they distinguish the formal and informal way of talking mathematics and how they mediate between these two types of talking in local languages. The study involved two primary mathematics teachers in one semi-urban primary school in Malawi. The presented teachers have Chichewa as their home language and all come from the surrounding community. Data was collected through pre-observation interview, mathematics class observation and reflective interview with the two teachers separate. The finding suggest that where the local language is the language of learning and teaching (LoLT) students bring in their informal mathematical language, they are exposed to formal mathematical as used in the textbooks, however, what is valued is the informal mathematical language. Therefore, the conclusion is that there is need to help learners on the use of language of learning and teaching to share and negotiate the meaning for successful learning.

Keywords: mathematical language, local language, formal way of talking, informal way of talking

Introduction

In a mathematics classroom, it is well known that mathematics learning involves both informal and formal language (Setati & Adler, 2001). The language that people use to express mathematics in their everyday life is referred to as informal mathematical language and the standard use of terminology developed within a formal setting as formal mathematical language. Pimm (1987) explained that learners do not commonly explicitly hear or read much mathematics outside the classroom and so the mathematical language that they bring to a mathematics class is informal. In school settings, it is the formal mathematical language that is valued. Therefore, learners need to learn the distinction between the informal and formal way of talking mathematics. Learners learn formal mathematical language in a mathematics classroom through their mathematics teachers. They need to move from informal to formal way of talking mathematics in a classroom where the language of learning and teaching (LoLT) is the local language. In a classroom where the LoLT is the local language, what is the informal way of talking mathematics and what is the formal way of talking mathematics.

In this paper, I draw on my research experience in the lower primary classrooms where the LoLT is the local language in Malawi. In Malawi, we have a Language-in-Education Policy (LiEP) that encourages the use

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of local languages in the first four years (Standards 1 to 4) of schooling. The policy requires that learners in the first four years of schooling be taught in their home language. The policy stipulates that:

... With immediate effect all Standards 1, 2, 3, and 4 children in our schools be taught in their mother tongue or vernacular as a medium of instruction. (Secretary for Education’s Letter, 1996, Ref. No. IN/2/14)

This means that teachers teach mathematics in lower primary school in local languages. By allowing teachers to teach in local languages, it creates flexibility with the teachers that they are able to express themselves. The assumption in this paper is that just as there is a formal way of talking mathematics in English, there should also be a formal way of talking mathematics in local languages.

Even though it is a local language, there should be a formal way of talking mathematics that represent the literate mathematical talk and an informal way of talking mathematics in local languages. With the help of mathematics teachers learners are expected to move from informal way to formal way of talking mathematics.

Setati and Adler (2001) highlighted that learners in a mathematics classroom come with informal spoken mathematical language. The mathematics teacher helps the learners to move from informal mathematical language to formal mathematical language. It is the mathematics teacher in a mathematics classroom who acts as a model of how to speak mathematically for the learners to draw on. Hence, one thing that a learner does in a mathematics classroom is to learn a range of accepted ways in which mathematics is to be communicated and discussed through their mathematics teacher. This presents mathematics teachers with a big task of taking the learner from an informal way of talking mathematics to a formal one. In local languages, the challenge is how do mathematics teachers recognize the informal way of talking mathematics from the formal way of talking mathematics. What is it that distinguishes the formal and informal way of talking mathematics and how do mathematics teachers mediate between these two types of talking in local languages?

Pimm (1991) explained the two levels of which mathematics teachers may help their learners to move from informal mathematical language to formal mathematical language where the LoLT is the learners’ local language: To encourage learners to write down their informal mathematical language and then work on this language to formal mathematical language; and to work on the spoken informal language to a formal spoken language and then formal written language. However, Setati and Adler (2001) suggested that movement from informal to formal mathematical language in a multilingual classroom may go through three routes: from spoken to written language; from main language to English; and from informal to formal mathematical language. This is shown in Figure 1.

Setati and Adler (2001) continued to argue that one way is to encourage learners to write down their informal utterances in the main language, then write them in informal mathematical English, and finally to work on making the written mathematical English more formal. In this case, the mathematics teacher works first on learners’ writing their informal mathematical thinking in both languages, and thereafter on formalizing and translating the written mathematics into the LoLT. Another possibility is to work first on translating the informal spoken mathematical language into spoken English and then to work on formalizing and writing the mathematics.

Setati and Adler (2001) continued to argue that while formal written mathematics in the learners’ main language(s) is possible, there is a variety of reasons why most multilingual teachers would not work on formalizing spoken and written mathematics in their main language because of: (1) The mathematics register is not well developed in most of the African languages; and (2) Due to the dominance of English
generally be seen/interpreted as a waste of time. This reflects the huge work that mathematics teachers have in a multilingual classroom, helping learners to be able to use mathematical language in a language that is not their home or first language, and at the same time, they should be helped to move from informal to formal way of talking mathematics.

Moschkovich (1999) explained another way of how a teacher in a bilingual mathematics classroom in the USA supported the mathematical communication of his learners. The teacher supported the learners by revoicing, interpreting, and rephrasing what learners were saying. For example, in the class that she was conducting her study, the teacher asked the learners to tell her something about a rectangle that is different from a triangle. One of the learners said that, “The rectangle has a parallelogram and triangle does not have parallelogram” (p. 14). The teacher revoiced the learner’s statement as “this is not a parallelogram” (p. 14) meaning the triangle is not a parallelogram. In her paper, she indicated that revoicing kept the discussion mathematical. Thus, teachers in a multilingual classroom can revoice, interpret, and rephrase the learners’ informal mathematical statements to formal mathematical language, thereby, enabling learners to move from everyday language to a formal mathematical language in a classroom. The difficulty is, however, that sometimes a teacher and a learner may speak from different points of view (Moschkovich, 1999, p. 15). Furthermore, how do the teachers rephrase or revoice the learners’ utterances in order to avoid embarrassing or exposing the learners or changing the meaning of the learners’ response, so that the revoicing should not discourage the learners in trying to express themselves? What should the teacher focus on: What the learner says, how it is said, or both?

Another way of helping learners, as explained by Halai (2001), is that teachers may prepare tasks that are set using the language and everyday life experiences of the learners. The assumption is that using the learners’ language and everyday situations may facilitate learning and ease the need for translation. However, the use of
everyday language in preparing tasks for the learners may lead to more difficulties and challenges, especially if the teacher ignores some of the unquestioned assumptions. Everyday language varies from learner to learner in a classroom because of reasons, such as differences in age, stage of understanding, and exposure or background. Learners might come up with different meanings among themselves and also meanings different from the teacher’s since familiarity with the LoLT is not the same for all the learners in the class. The challenge for a teacher is how to find “a balanced language and experiences” to fit all age groups with different language backgrounds in a mathematics classroom. All this requires a great deal of the teacher’s own “best” judgments. Another problem might be that everyday language for some learners, whether at school or at home, may not have prepared them for the kind of problems that they meet. For example, some learners may want to be told and be directed rather than to do things on their own.

In Malawi, even though the use of local languages as LoLT is in place, little has been done into help teachers cope with the implementation. Teachers guides are in English and the lesson plans that teachers write in preparation for their classes are done in English. In addition to that mathematics register in local languages in Malawi is not well developed. This poses a challenge as to what the standard way of mathematical language/register is in classrooms. This means that standard way of talking mathematics might be different in different classes depending on location of the school and the kind of teacher teaching mathematics. Therefore, it might be difficult to categorize the formal way of talking mathematics from the informal way of talking mathematics. This research implies that teaching and learning mathematics is difficult even so when the mathematical register is not well developed in local languages and this means a lot of work for teachers to help their learners to gain relevant knowledge of mathematical language in local languages which includes its register, procedures, terms, and concepts in the LoLT which is the local languages.

This literature provides insights and raises some questions regarding helping the mathematics teachers to see how they can help their learners move from informal mathematical language to formal mathematical language where LoLT is the local language. First, what knowledge and skills do mathematics teachers need in order to be able to mediate between their learner’s informal mathematical language and formal mathematical language?

**Background to the Language-in-Education Policy in Malawi**

The LiEP, in Malawi has undergone tremendous changes influenced by those ruling the country. Malawi was a British protectorate, up until 1964, before independence in 1964. The British adopted Nyanja as the official language and used the home languages of the people in the particular area as the LoLT during the first two years of schooling. After independence in 1964 under the leadership of President Kamuzu Banda, who ruled until 1994? During this period, Chichewa became the national language and was adopted as the only LoLT for the first four years of schooling (Standards 1 to 4) while English was the LoLT beginning from the fifth year of schooling (Chilora, 2000). Thus, learners in public schools had to learn mathematics through Chichewa irrespective of whether Chichewa was their home language or not. Since 1994, Malawi is a multiparty state and this change in politics has ushered in a multitude of progressive policy changes in education. A new LiEP, which required learners in the first four years of schooling to be taught in their home language, was introduced in 1996. The policy stipulates that:

... With immediate effect all Standards 1, 2, 3, and 4 children in our schools be taught in their mother tongue or vernacular as a medium of instruction. (Secretary for Education’s Letter, 1996, Ref. No. IN/2/14)
Thus, according to this LiEP, learners from Standard 1 to 4 are supposed to learn mathematics in their home language. However, the government policy still indicates that English remains the major LoLT for all the upper classes in primary, secondary (high) schools and tertiary education. Table 1 shows the LiEP in summary.

Table 1

<table>
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<th>Malawi National Policy on LoLT</th>
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<tr>
<td>Level of education</td>
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<td>I  Lower primary education (Standards 1-4)</td>
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<td>II Upper primary education (Standards 5-8)</td>
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<td>III Primary teacher education</td>
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In addition, in Malawi, English is the official language and Chichewa, which is spoken by about 50% of the population (Baldauf & Kaplan, 2004), is the national language. Besides these languages there are 16 other indigenous languages.

Mathematical Language as Used in This Article

Pimm (1991) explained that there are many different relationships that can be highlighted between mathematics and language. Mathematics has its own register (Halliday, 1975; Pirie, 1998), rules, grammar, syntax, vocabulary, word order, synonyms, negations, conventions, abbreviations, sentence structure, and paragraph structure (Esty & Teppo, 1994, p. 1). Halliday (1975) specified the notion of register as “a set of meanings that is appropriate to a particular function of language, together with the words and structures which express these meanings.” Lee and Fradd (1998) explained that appropriate use of key mathematical terminology is an indicator of the precision and sophistication of understanding. Therefore, part of learning mathematics is gaining control over the mathematics register, so that one is able to talk like a mathematician (Pimm, 1991).

In a classroom where LoLT is the local language of the learners, the definition of mathematical language does not change. Mathematical language in local languages uses the same standard mathematical terms only that they are expressed in the local language. This means that the complexity of mathematical language is the same as in local languages. This implies that the mathematical language in local languages still adds on to the complexity of teaching and learning mathematics in different ways. For example, mathematical language differs from the ordinary language in different ways. Mathematical language expressed in local languages will continue to have certain language features, for example, that cannot be matched with other languages. In addition, mathematical language in local languages will include everyday vocabulary that takes on a different meaning in mathematics; for example, words like “maonekedwe a zithu” might mean the colour, the size, or the shape of an object. Learners are expected to know and become familiar with this type of language, which they should be able to negotiate their meanings in a mathematics class.

Moreover, Morgan (1998) and Pimm (1991) explained that while mathematics, when spoken, emerges in a natural language, when written, it makes varied use of a complex, rule-governed writing system mainly separate from that of the natural language into which it can be read. Such mathematical encoding includes symbol order, position, relative size, and orientation (Pimm, 1991). Morgan (1998) called this “writing system” as “mathematical academic writing” (p. 11). Which means that, teachers in a mathematics classroom have the duty of helping their learners to write mathematically that is, using symbols in a correct order. Does the
“mathematical academic writing” change when it comes to local languages? If not then the teacher has the duty to help write the “mathematical academic writing” in local languages. In other words, using local languages as LoLT may not necessarily mean that mathematics will be lesser difficult, but as Setati (2005) put it, it is just a resource in a mathematics classroom, so that teachers should concentrate teaching the mathematics only rather than focusing on the language of which both teachers and learners are learning. However, as discussed above, some of the challenges are the same even when local languages are used as LoLT, such as when it comes to mastering the register.

As it can be seen that even though LoLT can be the local language of the learners, it is seen that from the mathematical language alone, teachers have an enormous task in trying to get their learners to learn mathematics, thereby accomplishing their education objectives in a mathematics classroom. Yes, most of the things mentioned in the preceding section can be easily done if the LoLT is the home language of both the learners and the teachers, but that does not mean that the complexity of mathematics language will go.

**Methodology**

The sample in this study included two primary mathematics teachers in one semi-urban primary school in Malawi and their learners. The teachers were selected purposefully (Patton, 1990) based on the criteria that they were teaching the lower classes that uses local languages as language of learning and teaching. Each mathematics teacher had primary school teachers’ certificate and had at least two years of teaching experience. They were also selected on the basis of their willingness to participate in the study.

The two mathematics teachers to be presented have Chichewa as their home languages and also almost all the learners came from the surrounding community where Chichewa is their local language.

The research methods employed in this study included pre-observation interviews with each mathematics teacher separately. Mathematics lesson observations and reflective interviews with each mathematics teacher on the classes observed. These interviews depended on the lessons observed and were facilitated by showing the mathematics teachers selected video recordings of their lessons. All the interviews were tape recorded and the classroom observations were video recorded.

**Findings and Discussion**

The findings of this research show that using the local language as language of learning and teaching at lower primary school may inhibit the learning of mathematics, more especially when the teacher fails to see or make judgment on when to use what and how? For example, in this study the teacher was teaching how to classify objects in a three dimension space, some of the things that were supposed to be classified were the objects with four corners, a cylinder and a ball. The teacher asked the learners to explain the four cornered object as shown in Extract 1.

**Extract 1**

T: lero tiphunzira zithu zosiyanasiyana, tinene mmene ifeyo timaisonera zithu zathu kukhala zosiyana siyana, ine yopabolodipa ndalembe, ndanjambula zithu zosiyanasiyana, kodi ichi, ichi mmene chikuonekeramu chikuoneka kuti ndichotani maonekedwe ake [Today, we are going to learn different things, we should explain the way we see our different things, on this blackboard I have written, I have drawn different objects, how can you describe this thing as you can see it here].

St 5: Cha godya [has corners].
T: cha makona, akuti chamakona kapena kuti changodya, eya makanawa alipo folo, tiyeni tiwerengeni [has corners, he says has corners which can also be said corners, yes, there are four corners, let us count them].

All: 1, 2, 3, 4 [1, 2, 3, and 4].

T: Folo, chamakona 4 kapena kuti changodya folo folo, mmene ili kalasi inonso iliindimakona folo, tamvana eti [4, with 4 corners, or with 4 corners, just as this class, it has 4 corners okay].

In Extract 1, the learner’s response was “Cha godya” meaning “with corners.” The word “cha godya” is the correct Mathematical Chichewa term for “Corners,” so the learner was right. In response to the answer the teacher said “cha makona, akuti chamakona kapena kuti chagodya” in line 6. The observation here is that the teacher revoices the answer given by the student. However, in her revoicing she did not immediately use the same term that the learner used “Cha ngodya.” She used another term that is “Cha makona” which is a Chichewa mathematical term that is used informally outside the classroom. She, however, revoiced the term used by the student latter in the in the sentence. In lines 9 and 10, she does the same thing revoiced the mathematical term with a different word and then later revoiced with the same term as the student. The impression here is that she would rather see or hear the learners use the word “chamakona” rather than “Changodya.” She tried to show the learners that “godya” means “chamakona.”

Our observation here is that “Chagodya” is not a common Chichewa word to both the teacher and the learners. It is a formal mathematical term that is mostly used in the textbooks. However, there is a common word that is “Chamakona” which is the English word but spoken as Chichewa.

Exactly the same thing but with a different word happened immediately after the episode above as shown in Extract 2.

Extract 2

T: Chabwino, tili pachiwiri, ndani angatiuze [Okay, we are on the second line, who can tell us].

Std 9: Chandendeya [It is round].

T: akuti chozungulira, titeni tonse tinene chozungulira [She says it is round, let us all say round].

All: chozungulira [Round].

T: tikanena kuti chozungulira ndi ndendeya ndichimodzimodzi eti [If we say round and round it means the same thing okay].

All: eeh [Yes].

T: tiyeni tigwiritse Chichewa chimodzi, ndichozungulira [Lets use one word, it is round].

The student in line 12 responded by saying “Chandendeya” meaning “round.” “Ndendeya” is the formal mathematical term used in textbooks. However, the teacher immediately revoiced the answer with a different Chichewa name “chozungulira” in line 13 which also means “round,” but this term is a common word used outside the classroom. She tells the learners to repeat after her the word “Chozungulira” in line 13. Latter, in line 15, the teacher explained that the two words “chandendeya” and “chozungulira” are the same. Then, line 17, the teacher actually encourages the learners to use one word to avoid confusion and the word she recommends is “chozungulira.” It should be pointed out here that the words “Chandendeya” and “godya” are not the common words that are used in the community, however, they are words being used in the learner’s books and teacher’s guides and are considered as formal mathematical terms in the local language.

The point that I am trying to bring to the fore is that when the LoLT is not the learners’ local language, the learners are not familiar with the language used as a result, teachers pronounce the English mathematical terms...
as if it is the local language. For example, a term “corner” is pronounced as “Kona” in the local language. Likewise, it has been observed here that the mathematical terms used in local languages are not unfamiliar terms to both the learners and teachers. Therefore, teachers resort to the use of the English mathematical term, but pronounced as if it is a local language term. This reveals the dilemma that mathematics teachers face when the LoLT is the local language and have terms that are in local language but unfamiliar.

The extracts above have shown that every time when the formal mathematical Chichewa term is used, the teacher had to revoice using the informal mathematical Chichewa term. The author’s understanding is that the teacher used the informal mathematical Chichewa terms, because they are common and the learners are familiar with rather than the formal mathematical Chichewa term. The teacher used this word so that it is easier for the learners to understand what the objects are. It is also observed that she actually encourages the learners to choose to use these informal mathematical Chichewa terms. The learners also were encouraged to repeat after the teacher the informal mathematical Chichewa terms. Through the text books they are exposed to the formal mathematical Chichewa words, but in class the teacher takes the learners from the formal mathematical Chichewa terms to informal mathematical Chichewa terms.

Setati and Adler (2001) explained that the language that people use to express mathematics in their everyday life is referred to as informal mathematical language and the standard use of terminology developed within a formal setting as formal mathematical language. In this particular case where local language is used a LoTL, the case is opposite. There is a formal Chichewa mathematical language as developed in lower primary mathematics books, such as the words that have been expressed above like “godya” and “ndendeya.” In this paper, the author calls these words as standard, because they are words that are used in the books and teachers guide.

However, when the teacher revoiced, she did not use the formal mathematical term, rather, she used what I call the informal mathematical language in a classroom where local language is a language of learning and teaching. The move in this particular case is from formal mathematical language to informal mathematical language. In other words, it is the informal Chichewa mathematical language that is valued than the formal Chichewa language. The reason in this case might be because the informal Chichewa mathematical languages are closer to the formal English mathematical language. This implies that even though the LoLT is the local language of the learners, learners still need to be helped to use the language to work effectively together, to share and negotiate meanings in their classrooms.

Therefore, it is argued here that learners in a classroom where local language is used as the LoLT are helped to move from the informal mathematical language to formal Chichewa mathematical language then back to informal spoken mathematical language. In a class where English is the LoLT, learners are helped to move from informal mathematical language to formal mathematical language. In this particular case, the routes described by Setati and Adler (2001) as shown in Figure 2 can be rewritten as follows in a classroom where local language is a language of learning and teaching.

Figure 2 shows that in a classroom where LoLT is the local language the formal mathematical Chichewa language is not developed in the learners, what is developed is the informal spoken and written Chichewa language.

This argument is supported with how the teacher revoices the mathematical terms. Most of the words that the teacher uses are the informal mathematical Chichewa words, and she further encourages the learners to use one word instead of both terms and the term that she chooses for the learners is the informal mathematical Chichewa term.
The teacher in Extract 2 recommends to the learners that they should use one language, however, as the lesson continued she was the one who continued to use both terms as seen in Extract 3.

Extract 3

*T: Chozungulira pansi ndi pamwamba, chabwino, takambirana kuti maonekedwe a zithu, zina zimakhala ndi makona folo kapena za godya folo, kapena zagodya zochulukirapo, koma lero taphunzira za godya folo, komanso tikuphunzira china cha ndendeya pansi ndi pamwamba ngati cup, tikuphunziranso china chimene changokhala chozungulira, tamvana eti,eya chabwino ndikufuna kuti inuyo mukhale mmagulu koma musanakhale mmundimveterendalembe zithu zosiyansiyana, magulunso osiyana siyana, mwachitsanzo [It is round on top and bottom, okay, we have discussed how to describe objects, other objects have 4 corners, or 4 corners, or with more than 4 corners, but today we have seen objects with 4 corners, or objects with more than 4 corners, … also we have we have learnt about objects which are round on top and bottom like a cup, so now I want you to be in groups …].

This seems that the teacher’s focus is divided between helping the learners understand the mathematics and the learners to know the Chichewa mathematical word. She could not believe it that if she is using one term without referring to the other; she is doing justice to the students, so she continued interpreting the two words as seen in Extract 3.

This particular lesson was followed up with the following conclusion in Extract 4.

Extract 4

*T: Chabwino, lero taphunzira chain [Okay today, what have learnt].

All: masamu [Mathematics].

*T: zimene taphunzira, maonokedwe a zithu, chabwino wina abwere kutsogolo kuno adzatilozere chithu cha ndendeya kapena kuti chozungulira [We have learnt the description of different objects, okay, can one person come forward to show us the round object or ….].
Extract 4 is the conclusion of the lesson under discussion. In this part of the lesson, the teacher asked the learners to point at the things that she was going to mention on the chalkboard. In line 29, the teacher says “…chithu chandendeya kapena Chozungulira….” The first word is the formal mathematical Chichewa term as expressed in textbooks while “chozungulira” is the informal Chichewa mathematical term. In line 33, the teacher says “…cha godya, changodya, changodya, kapena chamakona, chamakona, chamakona…,” and line 40, the teachers says “…chandendeya pansi ndi mwamba, kapena Chozungulira, chozungulira pansi ndi pamwamba….” In all these examples, it is the same approach; she starts with the formal mathematical Chichewa language and then the informal mathematical Chichewa language.

Furthermore, in all the four extracts given above, there is more attention given to the mathematical register. The mathematical terms are being revoiced again and again throughout the lesson. This helps learners to master the mathematical terms.

**Conclusions**

This study sought to illuminate the complexity of local languages as LoLT in a mathematics classroom. The study has shown that where the local language is the LoLT students bring in their informal mathematical language, they are exposed to formal mathematical as used in the textbooks, however, what is valued is the informal mathematical language.

The conclusion is that just as in other mathematical classrooms as discussed in different research reports, in a classroom where LoLT is the local language, the mediation by the teacher is needed despite the LoLT. It shows that teaching and learning mathematics in local languages does not ease the task that mathematics teachers encounter as they teach mathematics. There is need to help learners on the use of language of learning and teaching to share and negotiate the meaning. This is as a result of factors which have been reported in different reports as well as approaches which this study has identified being repeated and emphasized at different points as a way of helping the learner to understand.

This study identifies that in a classroom where language of learning and teaching is a local language, the formal mathematical Chichewa language is not developed in the learner, what is developed is the formal spoken and written Chichewa language. Further analysis reveals that teachers in terms of everyday experience and sense of purpose use creativity to choose the language which will help the learner understand the concept.
References


